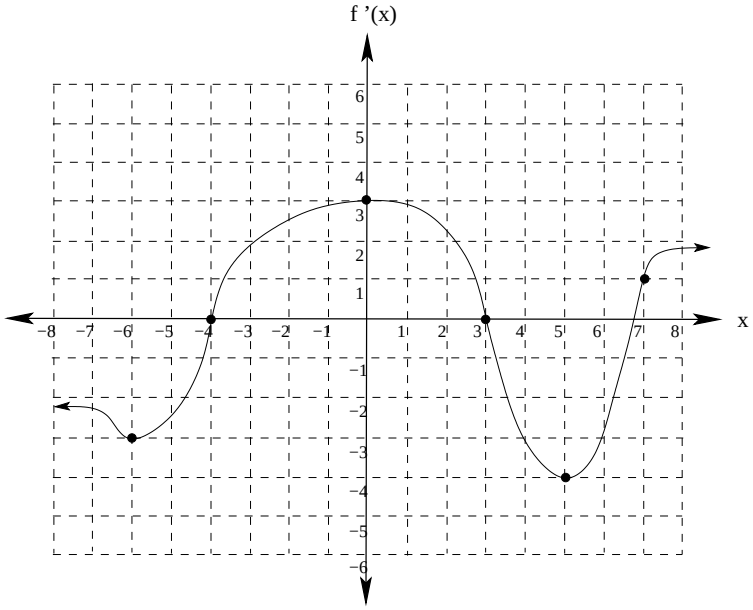
1. Answer the following questions based on the graph of $f'(x)$ shown below:



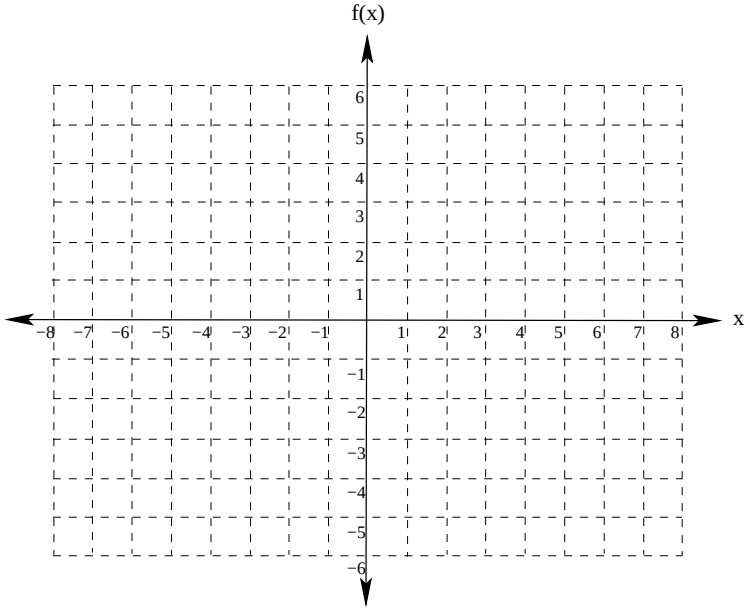
Find the following:

(a) Find the intervals on which $f(x)$ is increasing.

(b) Find the intervals on which $f(x)$ is decreasing.

(c) Where are the local maxima of $f(x)$?

(d) Where are the local minima of $f(x)$?



(e) When is $f(x)$ increasing the fastest?

(f) When is $f(x)$ decreasing the fastest?

(g) In the space provided above, sketch a possible graph of $f(x)$ given that $f(0) = 2$

2. For each of the following functions, (i) find all critical numbers, (ii) determine where the function is increasing and where it is decreasing, (iii) determine whether each critical number represents a local maximum, local minimum, or neither, and (iv) use this information to sketch the graph of the function.

   (a) $f(x) = 2x^3 - 9x^2 - 108x + 50$

   (b) $g(x) = \dfrac{x^2}{x-3}$

3. Sketch a graph of a function f satisfying all of the following properties:
   $| f(x) | < 2$ for all x; $f(-3) = f(-1) = 0$; $f'(x) < 0$ for $x < -2$ and $f'(x) > 0$ for $x > -2$; $f(-2)$ is undefined; and $\lim_{x \to -2^-} f(x) > \lim_{x \to -2^+} f(x)$

4. A section of rollercoaster is in the shape of $y = -\frac{3}{5}x^5 + 5x^3 - 12x + 70$, where $-3 \leq x \leq \frac{5}{2}$. Find all local extrema and explain what the corresponding portions of the roller coaster are. Where are the highest and lowest points on this section of rollercoaster track? Sketch a graph of this section of the rollercoaster. Where do you think the rollercoaster is traveling the fastest?